

## CLAIMS

### WE CLAIM:

- 5           1.     An aqueous preservation medium for preserving biological materials,  
              comprising:
  - (a) a biological material;
  - (b) at least one polyhydroxy compound, where the total amount of polyhydroxy  
              compound in the medium is from about 5% to about 60% by weight of the  
10           medium; and
  - (c) phosphate ions, where the total amount of phosphate ions in the medium is  
              such that the molar ratio of phosphate ions to hydroxyl groups in the  
              polyhydroxy compound is from about 0.025 to about 0.625.
- 15          2.     The aqueous preservation medium of claim 1, where the pH of the  
              medium is from about 5 to about 10.
3.     The aqueous preservation medium of claim 1, where the polyhydroxy  
              compound is selected from a group consisting of monosaccharides, disaccharides, and  
              polysaccharides.
- 20          4.     The aqueous preservation medium of claim 3, where the polyhydroxy  
              compound is trehalose.
5.     The aqueous preservation medium of claim 1, where the total amount of  
              polyhydroxy compound in the medium is from about 10% to about 30% by weight of  
              the medium.

6. The aqueous preservation medium of claim 3, where the total amount of polyhydroxy compound in the medium is from about 10% to about 30% by weight of the medium.

7. The aqueous preservation medium of claim 1, where the molar ratio of phosphate ions to hydroxyl groups in the polyhydroxy compound is from about 0.0375 to about 0.625.

8. The aqueous preservation medium of claim 1, where the biological material is selected from the group consisting of cells, proteins, and enzymes.

9. An aqueous preservation medium for preserving biological materials, comprising:

(a) a biological material;

(b) trehalose, where the trehalose is present in an amount from about 5% to about 60% by weight of the medium; and

(c) phosphate ions, where the total amount of phosphate ions in the medium is such that the molar ratio of phosphate ions to trehalose is from about 0.2 to about 5.

10. The aqueous preservation medium of claim 9, where the trehalose is present in an amount from about 10% to about 30% by weight of the medium.

11. The aqueous preservation medium of claim 10, where the pH is from about 5 to about 10.

12. The aqueous preservation medium of claim 9, where the molar ratio of phosphate ions to trehalose is from about 0.3 to about 5.

13. The aqueous preservation medium of claim 9, where the biological material is selected from the group consisting of cells, proteins, and enzymes.

14. A method of preparing a preserved biological material composition, comprising:

- 5 (a) forming an aqueous preservation medium comprising (i) a biological material; (ii) at least one polyhydroxy compound, where the total amount of polyhydroxy compound in the medium is from about 5% to about 60% by weight of the medium; and (iii) phosphate ions, where the total amount of phosphate ions in the medium is such that the molar ratio of phosphate ions to  
10 moles of hydroxyl groups in the polyhydroxy compound is from about 0.025 to about 0.625; and
- (b) preserving the aqueous preservation medium using at least one preservation process.

15. The method of claim 14, where the preservation processes are one or more processes selected from the group consisting of freezing, freeze-drying, ambient-air drying, vacuum-drying, and spray drying.

16. The method of claim 14, where the pH of the medium is from about 5 to about 10.

17. The method of claim 14, where the polyhydroxy compound is  
20 selected from a group consisting of monosaccharides, disaccharides, and polysaccharides.

18. The method of claim 14, where the polyhydroxy compound is trehalose.

19. The method of claim 14, where the total amount of polyhydroxy compound in the medium is from about 10% to about 30% by weight of the medium.

20. The method of claim 17, where the total amount of polyhydroxy compound in the medium is from about 10% to about 30% by weight of the medium.

5 21. The method of claim 14, where the molar ratio of phosphate ions to moles of hydroxyl groups in the polyhydroxy compound is from about 0.0375 to about 0.625.

22. The method of claim 14, where the biological material is selected from the group consisting of cells, proteins, and enzymes.

10 23. A method of preparing a preserved biological material composition comprising:

(a) forming an aqueous preservation medium comprising (i) a biological material; (ii) trehalose, where the total amount of polyhydroxy compound in the medium is from about 5% to about 60% by weight of the medium; and (iii)  
15 phosphate ions, where the total amount of phosphate ions in the medium is such that the molar ratio of phosphate ions to trehalose is from about 0.2 to about 5; and

(b) preserving the aqueous preservation medium using at least one preservation process.

20 24. The method of claim 23, where the preservation processes are one or more processes selected from the group consisting of freezing, freeze-drying, ambient-air drying, vacuum-drying, and spray drying.

25. The method of claim 23, where the trehalose is present in an amount from about 10% to about 30% by weight of the medium.

26. The method of claim 25, where the pH is from about 5 to about 10.

27. The method of claim 26, where the molar ratio of phosphate ions to  
5 trehalose is from about 0.3 to about 5.

28. The method of claim 23, where the biological material is selected from the group consisting of cells, proteins, and enzymes.

29. A protectant mixture in solid form for use in preserving biological materials, comprising:

10 (a) at least one polyhydroxy compound, where the total amount of polyhydroxy compound in the mixture is from about 10% to about 95% by weight of the mixture; and

(b) phosphate ions, where the total amount of phosphate ions in the mixture is such that the molar ratio of phosphate ions to hydroxyl groups in the  
15 polyhydroxy compound is from about 0.025 to about 0.625.

30. The protectant mixture of claim 29, where the total amount of polyhydroxy compound in the mixture is from about 20% to about 95% by weight of the mixture.

31. The protectant mixture of claim 29, where the polyhydroxy  
20 compound is selected from a group consisting of monosaccharides and polysaccharides.

32. The protectant mixture of claim 31, where the polyhydroxy compound is trehalose.

33. The protectant mixture of claim 29, where the molar ratio of phosphate ions to hydroxyl groups in the polyhydroxy compound is from about 0.0375 to about 0.625.

34. A protectant mixture in solid form for use in preserving biological materials, comprising:

- (a) trehalose, where the trehalose is present in the mixture in an amount from about 10% to about 95% by weight of the mixture; and
- (b) phosphate ions, where the total amount of phosphate ions in the mixture is such that the molar ratio of phosphate ions to trehalose is from about 0.2 to about 5.

35. The protectant mixture of claim 34, where the trehalose is present in an amount from about 20% to about 95% by weight of the mixture.

36. The protectant mixture of claim 34, where the molar ratio of phosphate ions to trehalose is from about 0.3 to about 5.

37. A protectant mixture in the form of an aqueous solution, comprising:

- (a) at least one polyhydroxy compound, where the total amount of polyhydroxy compound in the mixture is from about 5% to about 60% by weight of the mixture; and
- (b) phosphate ions, where the total amount of phosphate ions in the mixture is such that the molar ratio of phosphate ions to hydroxyl groups in the polyhydroxy compound is from about 0.025 to about 0.625.

38. The protectant mixture of claim 36, where the total amount of polyhydroxy compound in the mixture is from about 10% to about 30% by weight of the mixture.

39. The protectant mixture of claim 37, where the polyhydroxy compound is selected from a group consisting of monosaccharides and polysaccharides.

40. The protectant mixture of claim 39, where the polyhydroxy compound is trehalose.

41. The protectant mixture of claim 37, where the molar ratio of phosphate ions to hydroxyl groups in the polyhydroxy compound is from about 0.0375 to about 0.625.

42. A protectant mixture in the form of an aqueous solution, comprising:

(a) trehalose, where the trehalose is present in the mixture in an amount from about 5% to about 60% by weight of the mixture; and

(b) phosphate ions, where the total amount of phosphate ions in the mixture is such that the molar ratio of phosphate ions to trehalose is from about 0.2 to about 5.

43. The protectant mixture of claim 42, where the trehalose is present in an amount from about 10% to about 30% by weight of the mixture.

44. The protectant mixture of claim 42, where the molar ratio of phosphate ions to trehalose is from about 0.3 to about 5.

45. A preserved biological material composition made by the method of claim 14 or claim 23.